

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

| | | |
|--|---|--|
| Applicant's or agent's file reference BP101833 | FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below. | |
| International application No. PCT/FI 01/ 00599 | International filing date (day/month/year) 25/06/2001 | (Earliest) Priority Date (day/month/year) 26/06/2000 |
| Applicant NOKIA NETWORKS OY | | |

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

5

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☐ None of the figures.

1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 01/00599

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 12/56, H04Q 7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPO INTERNAL, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| X | WO 9736405 A1 (NOKIA TELECOMMUNICATIONS OY), 2 October 1997 (02.10.97), page 4, line 12 - line 14; page 5, line 23 - line 26; page 7, line 18 - line 21 -- | 1-14 |
| A | WO 9407316 A1 (NETWORK EQUIPMENT TECHNOLOGIES, INC.), 31 March 1994 (31.03.94), page 32, line 36 - page 33, line 7; page 27, line 23 - line 29 -- | 1-14 |
| A | WO 9905828 A1 (TELEFONAKTIEBOLAGET LM ERICSSON (PUBL)), 4 February 1999 (04.02.99), abstract -- | 1-14 |

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

7 November 2001

Date of mailing of the international search report

30. 11. 2001

Name and mailing address of the International Searching Authority
European Patent Office P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel(+31-70)340-2040, Tx 31 651 epo nl,
Fax(+31-70)340-3016
Facsimile NO.

Authorized officer

PEDER GJERVALDSAETER/AE

Telephone No.

2
INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 01/00599

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---|-----------------------|
| A | EP 0777396 A1 (NOKIA MOBILE PHONES LTD. ET AL.), 4 June 1997 (04.06.97), abstract -- ----- | 1-14 |

INTERNATIONAL SEARCH REPORT
Information on patent family members

354277

01/10/01

International application No.

PCT/FI 01/00599

| Patent document cited in search report | | | Publication date | Patent family member(s) | | | Publication date |
|---|---------|----|---------------------|----------------------------|------------|---|---------------------|
| WO | 9736405 | A1 | 02/10/97 | AU | 2162097 | A | 17/10/97 |
| | | | | CA | 2250040 | A | 02/10/97 |
| | | | | CN | 1214832 | A | 21/04/99 |
| | | | | EP | 0886938 | A | 30/12/98 |
| | | | | FI | 103005 | B | 00/00/00 |
| | | | | FI | 961363 | A | 26/09/97 |
| | | | | JP | 2000507416 | T | 13/06/00 |
| WO | 9407316 | A1 | 31/03/94 | AU | 670126 | B | 04/07/96 |
| | | | | AU | 4921593 | A | 12/04/94 |
| | | | | CA | 2144154 | A | 31/03/94 |
| | | | | EP | 0746921 | A | 11/12/96 |
| | | | | JP | 8501424 | T | 13/02/96 |
| | | | | US | 5444702 | A | 22/08/95 |
| | | | | US | 5633869 | A | 27/05/97 |
| WO | 9905828 | A1 | 04/02/99 | AU | 8369898 | A | 16/02/99 |
| | | | | BR | 9810796 | A | 25/07/00 |
| | | | | CN | 1271488 | T | 25/10/00 |
| | | | | EP | 0997018 | A | 03/05/00 |
| | | | | AU | 4321899 | A | 20/12/99 |
| | | | | EP | 1084099 | A | 21/03/01 |
| | | | | US | 6040464 | A | 21/03/00 |
| | | | | WO | 9962861 | A | 09/12/99 |
| EP | 0777396 | A1 | 04/06/97 | AU | 716622 | B | 02/03/00 |
| | | | | AU | 7042396 | A | 05/06/97 |
| | | | | CN | 1156945 | A | 13/08/97 |
| | | | | FI | 101763 | B | 00/00/00 |
| | | | | FI | 955812 | A | 02/06/97 |
| | | | | JP | 9186704 | A | 15/07/97 |
| | | | | NO | 965020 | A | 02/06/97 |
| | | | | US | 5940371 | A | 17/08/99 |

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLAND

Berggren Oy Ab

05 -12- 2001

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

Date of mailing
(day/month/year)

30/11/2001

Applicant's or agent's file reference

BP101833

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/FI 01/ 00599

International filing date

(day/month/year)

25/06/2001

Applicant

NOKIA NETWORKS OY

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within **19 months** from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within **20 months** from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Claude Berthon

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments and any accompanying statement, under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the time of filing the amendments (and any statement) with the International Bureau, also file with the International Preliminary Examining Authority a copy of such amendments (and of any statement) and, where required, a translation of such amendments for the procedure before that Authority (see Rules 55.3(a) and 62.2, first sentence). For further information, see the Notes to the demand form (PCT/IPEA/401).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PATENT COOPERATION TREATY

BP101833
SKU/MM

Berggren Oy Ab

12 -12- 2001

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

| | |
|---|---|
| Date of mailing (day/month/year) 06 December 2001 (06.12.01) | IMPORTANT NOTIFICATION |
| Applicant's or agent's file reference BP101833 | |
| International application No. PCT/FI01/00599 | International filing date (day/month/year) 25 June 2001 (25.06.01) |

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

| | | |
|--|----------------------------|--------------------------|
| Name and Address NOKIA NETWORKS OY P. O. Box 300 FIN-00045 Nokia Group Finland | State of Nationality FI | State of Residence FI |
| | Telephone No. | |
| | Facsimile No. | |
| | Teleprinter No. | |

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person ☒ the name ☒ the address ☐ the nationality ☐ the residence

| | | |
|---|-------------------------------|--------------------------|
| Name and Address NOKIA CORPORATION Keilalahdentie 4 FIN-02150 Espoo Finland | State of Nationality FI | State of Residence FI |
| | Telephone No. 214-922-9221 | |
| | Facsimile No. 214-969-7557 | |
| | Teleprinter No. | |

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

| | |
|--|---|
| <input checked="" type="checkbox"/> the receiving Office | <input type="checkbox"/> the designated Offices concerned |
| <input type="checkbox"/> the International Searching Authority | <input type="checkbox"/> the elected Offices concerned |
| <input type="checkbox"/> the International Preliminary Examining Authority | <input type="checkbox"/> other: |

| | |
|---|--|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35 | Authorized officer Philippe Bécamel Telephone No.: (41-22) 338.83.38 |
|---|--|

PCT

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

BERGGREN OY AB
P.O. Box 16
FIN-00101 Helsinki
FINLANDE

Berggren Oy Ab

11 -01- 2002

SW/M

| | | |
|--|---|---|
| Date of mailing (day/month/year) 03 January 2002 (03.01.02) | | |
| Applicant's or agent's file reference BP101833 | | IMPORTANT NOTICE |
| International application No. PCT/FI01/00599 | International filing date (day/month/year) 25 June 2001 (25.06.01) | Priority date (day/month/year) 26 June 2000 (26.06.00) |
| Applicant NOKIA CORPORATION et al | | |

1. Notice is hereby given that the International Bureau has **communicated**, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this notice:
KP, KR, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:
AE, AG, AL, AM, AP, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EA, EC, EE, EP, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OA, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG,

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this notice is a copy of the international application as published by the International Bureau on 03 January 2002 (03.01.02) under No. WO 02/01818

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and the PCT Applicant's Guide, Volume II.

| | |
|--|--|
| The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35 | Authorized officer <p style="text-align: center;">J. Zahra</p> Telephone No. (41-22) 338.91.11 |
|--|--|

Continuation of Form PCT/IB/308

NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF
THE INTERNATIONAL APPLICATION TO THE DESIGNATED OFFICES

| | |
|---|---|
| Date of mailing (day/month/year) 03 January 2002 (03.01.02) | IMPORTANT NOTICE |
| Applicant's or agent's file reference BP101833 | International application No. PCT/FI01/00599 |
| <p>The applicant is hereby notified that, at the time of establishment of this Notice, the time limit under Rule 46.1 for making amendments under Article 19 has not yet expired and the International Bureau had received neither such amendments nor a declaration that the applicant does not wish to make amendments.</p> | |

PCT REQUEST

BP101833

Original (for SUBMISSION) - printed on 25.06.2001 10:45:39 AM

| | | |
|----------------|--|---|
| 0 | For receiving Office use only | |
| 0-1 | International Application No. | |
| 0-2 | International Filing Date | |
| 0-3 | Name of receiving Office and "PCT International Application" | |
| 0-4 | Form - PCT/RO/101 PCT Request | |
| 0-4-1 | Prepared using | PCT-EASY Version 2.91 (updated 01.01.2001) |
| 0-5 | Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty | |
| 0-6 | Receiving Office (specified by the applicant) | National Board of Patents and Registration (Finland) (RO/FI) |
| 0-7 | Applicant's or agent's file reference | BP101833 |
| I | Title of invention | TRANSMISSION METHOD FOR PACKET DATA AND A NETWORK ELEMENT |
| II | Applicant | |
| II-1 | This person is: | applicant only |
| II-2 | Applicant for | all designated States except US |
| II-4 | Name | NOKIA NETWORKS OY |
| II-5 | Address: | P. O. Box 300 FIN-00045 Nokia Group Finland |
| II-6 | State of nationality | FI |
| II-7 | State of residence | FI |
| III-1 | Applicant and/or inventor | |
| III-1-1 | This person is: | applicant and inventor |
| III-1-2 | Applicant for | US only |
| III-1-4 | Name (LAST, First) | ISOKANGAS, Jari |
| III-1-5 | Address: | Itsenäisyydenkatu 8 C 43 FIN-33500 Tampere Finland |
| III-1-6 | State of nationality | FI |
| III-1-7 | State of residence | FI |

PCT REQUEST

BP101833

Original (for SUBMISSION) - printed on 25.06.2001 10:45:39 AM

| | | |
|--------------|---|--|
| III-2 | Applicant and/or inventor | |
| III-2-1 | This person is: | applicant and inventor |
| III-2-2 | Applicant for | US only |
| III-2-4 | Name (LAST, First) | SARKKINEN, Sinikka |
| III-2-5 | Address: | Aittakatu 6 D 18 FIN-33560 Tampere Finland |
| III-2-6 | State of nationality | FI |
| III-2-7 | State of residence | FI |
| III-3 | Applicant and/or inventor | |
| III-3-1 | This person is: | applicant and inventor |
| III-3-2 | Applicant for | US only |
| III-3-4 | Name (LAST, First) | VIRTANEN, Jukka |
| III-3-5 | Address: | Keskuskatu 38 B 8 FIN-37550 Lempäälä Finland |
| III-3-6 | State of nationality | FI |
| III-3-7 | State of residence | FI |
| IV-1 | Agent or common representative; or address for correspondence | |
| | The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: | agent |
| IV-1-1 | Name | BERGGREN OY AB |
| IV-1-2 | Address: | P. O. Box 16 FIN-00101 Helsinki Finland |
| IV-1-3 | Telephone No. | +358-9-693701 |
| IV-1-4 | Facsimile No. | +358-9-6933944 |
| IV-1-5 | e-mail | email.box@berggren.fi |

| | | |
|--------|--|---|
| V | Designation of States | |
| V-1 | Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned) | <p>AP: GH GM KE LS MW MZ SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT</p> <p>EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT</p> <p>EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE TR and any other State which is a Contracting State of the European Patent Convention and of the PCT</p> <p>OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT</p> |
| V-2 | National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned) | <p>AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH&LI CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX MZ NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW</p> |
| V-3 | National Patent (States which have become party to the PCT after the issuance of this version of EASY) | <p>CO EC</p> |
| V-5 | Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. | |
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4/4

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| | | | |
|---------|--|---------------------------------------|-----------------------------|
| VI-2 | Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s): | VI-1 | |
| VII-1 | International Searching Authority Chosen | European Patent Office (EPO) (ISA/EP) | |
| VIII | Check list | number of sheets | electronic file(s) attached |
| VIII-1 | Request: | 4 | - |
| VIII-2 | Description | 13 | - |
| VIII-3 | Claims | 2 | - |
| VIII-4 | Abstract | 1 | EZABST00.TXT |
| VIII-5 | Drawings | 6 | - |
| VIII-7 | TOTAL | 26 | |
| | Accompanying items | paper document(s) attached | electronic file(s) attached |
| VIII-8 | Fee calculation sheet | ✓ | - |
| VIII-9 | Separate signed power of attorney | ✓ | - |
| VIII-10 | Copy of general power of attorney | ✓ | - |
| VIII-16 | PCT-EASY diskette | - | diskette |
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| IX-1 | Signature of applicant or agent | <i>Sirpa Kuisma</i> | |
| IX-1-1 | Name | BERGGREN OY AB | |
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| IX-1-3 | Capacity | Patent Attorney | |

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PCT (ANNEX - FEE CALCULATION SHEET)

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| | | |
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| 0-1 | International Application No. | |
| 0-2 | Date stamp of the receiving Office | |
| 0-4 | Form - PCT/RO/101 (Annex) | |
| 0-4-1 | PCT Fee Calculation Sheet Prepared using | PCT-EASY Version 2.91 (updated 01.01.2001) |
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PCT-EASY INFORMATION SHEET

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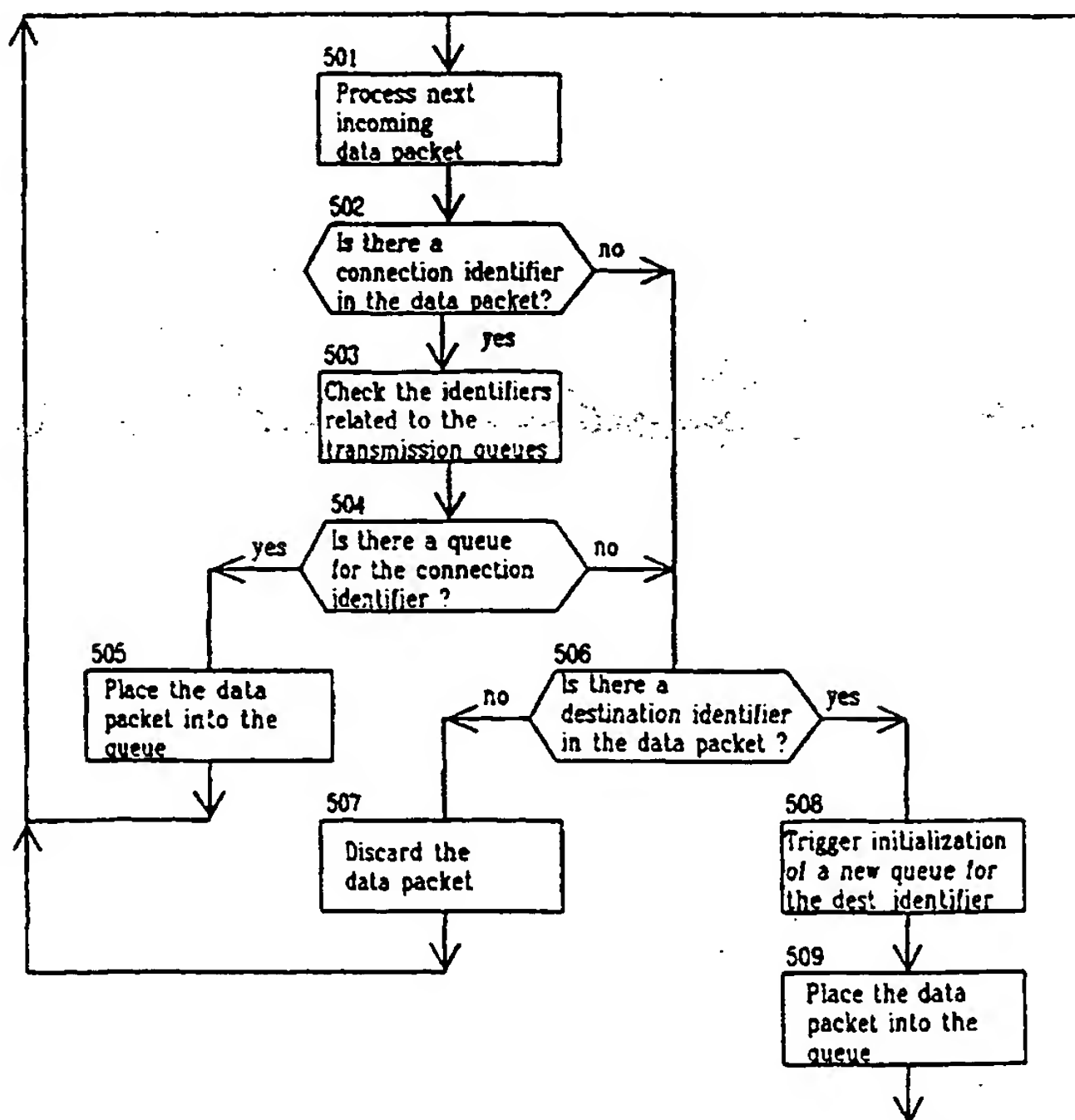
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(54) Title: TRANSMISSION METHOD FOR PACKET DATA AND A NETWORK ELEMENT

500



(57) Abstract: In packet data transmission method, a packet data connection is indicated with a connection identifier and the destination of the packet data connection is indicated with a destination identifier. A destination identifier is involved in the initialization of a transmission queue, at least one connection identifier is related to each transmission queue, and a set of proper connection identifiers is the union of the connection identifiers related to the initialized transmission queues. A data packet having a proper connection identifier is placed (504, 505) to the corresponding transmission queue. The method is characterized in that the initialization of a new transmission queue is triggered (506, 508) by a data packet not having a proper connection identifier and having a destination identifier and after a successful initialization of a new transmission queue the data packet that triggered the initialization is placed (509) to the new transmission queue. The method can be employed, for example, in a network element (800).

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Transmission method for packet data and a network element

5 The invention relates in general to packet data connections in cellular networks. In particular the invention relates to reserving resources for the packet data connections.

Traditionally cellular networks have been circuit switched networks, i.e. a certain part of the data transmission capacity both at the fixed network and in the radio access network is reserved for each call. This capacity is reserved during the whole call, even if no speech or other data is transmitted.

- 10 The popularity of applications that can be run conveniently over packet switched networks, applications such as electronic mail and browsing the World Wide Web, has caused need to enhance current cellular networks to support packet switched connections. For example, in Global System for Mobile communication (GSM) packet switched connections are provided by General Packet Radio Service (GPRS).
- 15 Existing GSM networks can be updated to carry packet data by adding proper network elements. With GPRS it should be possible, for example, use the radio resources in the radio access network more economically than by transmitting packet data in a circuit switched connection, i.e. in a data call, as can be done in GSM.
- 20 Universal Mobile Communication System (UMTS) is one of the future cellular networks that offer larger data transmission capacity than current cellular networks. UMTS supports packet switched connections, and same GPRS equipment as in GSM networks may be used there. In fact, GSM radio access networks and UMTS radio access networks may be connected to a common GPRS core network.
- 25 Figure 1 presents a schematic diagram of an exemplary GSM radio access network and GPRS core network. A mobile station (MS) 101 communicates with a base station (BTS) 102. One or more base stations are connected to a base station controller (BSC) 103 that is responsible, for example, for allocation of radio resources and for handling handovers, where a mobile station changes the base station it communicates with. The base stations and base station controllers form the
- 30 GSM radio access network. In addition to these components, a GSM network comprises Mobile Service Switching centers (MSC), Home Location Register (HLR) and Visitor Location Register (VLR). HLR and VLR take part in, for example, subscriber and mobility management.

The GPRS core network comprises GPRS supporting nodes (GSN). Of these nodes, the one which is on the edge towards a public data network, for example the Internet, is called Gateway GPRS supporting node (GGSN). In Figure 1, a GGSN 105 is presented. Data packets may run through many GSNs, which act as routers. A mobile station, which is the endpoint of the data connection, is reachable through one base station controller and the GSN connected to this base station controller is called Serving GPRS support node (SGSN). In Figure 1, the mobile station 101 is reachable via the BSC 103 and the GSN connected to this BSC is SGSN 104.

User data is transferred transparently between the MS and the external data networks with a method known as encapsulation and tunneling: data packets are equipped with GPRS-specific protocol information and transferred between the MS and GGSN. In order to access the GPRS services, a MS first makes its presence known to the network by performing a GPRS attach. This operation establishes a logical link between the MS and the SGSN, and makes the MS available for, for example, paging via SGSN and notification of incoming GPRS data.

The SGSN is at the same hierarchical level as the MSC, keeps track of the individual MSs' location and performs security functions and access control. The Gateway GSN provides interworking with external packet-switched networks, and is connected with SGSNs via an IP-based GPRS backbone network.

Figure 1 presents also exemplary protocol stacks that may be used in each network element for transmitting packet data. The GGSN 105 has protocol stack 115. The physical layer and the medium access layer are not specified and they are represented with symbols L1 and L2 in Figure 1. The protocol on the medium access layer protocol is Internet Protocol (IP), and on IP both User Datagram Protocol (UDP) and Transfer Control Protocol (TCP) may be run. In GPRS core network, data is transmitted using GPRS Tunneling Protocol (GTP). Data that is carried in the GTP packets is either IP packets or X.25 packets, as specified by the upmost layer in the protocol stack 115.

Towards the GGSN the protocol stack 114 of the SGSN is similar to that of the GGSN. It lacks the upmost layer of the GGSN protocol stack, because the data transmission protocol in GPRS core network is GTP. A base station controller and the base station connected to it form a base station system (BSS). The protocol stack 112 of a BSS is presented in Figure 1, too. Towards a BSS the SGSN has a different protocol stack than towards to GGSN. The common physical layer of the SGSN and BSS is L1bis, and Frame relay is used in the second protocol layer. The upmost

protocol layer between the SSGN and the BSS is Base Station System GPRS protocol (BSSGP). Over this protocol the SGSN still has Logical Link Control (LLC) and Subnetwork Dependent Convergence Protocol (SNDCP). LLC and SNDCP connections are between the SGSN and a mobile station. The interface
5 between a BSS and a SGSN is called Gb interface.

The base station system, or more precisely a base station, communicates with a mobile station using GSM RF as the physical layer. On this protocol there are Medium Access Control and Radio Link Control protocols. The base station system relays the data and signaling information between the RLC and BSSGP. The
10 protocol stack 111 of a mobile station comprises LLC and SNDCP protocols on top of RLC protocol. On these protocols there is a packet data protocol which is common with the GGSN. The application is the upmost layer in the protocol stack.

The protocol stacks in Figure 1 are those related to data transmission. Signaling, which relates, for example, to mobility management and resource reservation is
15 carried out using GSM Mobility Management and Session Management (GMM/SM) protocol in the place of SNDCP. Otherwise the signaling protocol stacks are similar to the data transmission protocol stacks presented in Figure 1.

In third generation future cellular networks, the base station subsystem comprises a controller, which in UMTS is called a radio network controller (RNC) and base
20 stations connected to the RNC. The base stations are here referred to as third generation base stations (3G-BTS) in order to distinct them from the base stations of a GSM radio access network, for example. Figure 2 presents as an example of a third generation cellular network an UMTS radio access network. The mobile station 201 that is compatible with the UMTS network is different from a GSM
25 mobile station 101. It communicates with a 3G-BTS 202 that is connected to a RNC 203. The RNC may be connected to a GPRS core network. This is in Figure 2 marked by presenting the RNC connected to a GPRS supporting node 104.

Figure 2 presents also the exemplary protocol stack 212 of the UMTS base station system. The protocol stack 212 is related to packet data. Towards a GPRS
30 supporting node, the lowest protocol layer is the same as that in the protocol stack 112 of the GSM base station system, but the upper layers in these protocol stacks are different. In UMTS base station system, Asynchronous Transfer Mode (ATM) is used in the medium access layer and GPRS tunneling protocol is the upmost protocol.

Because the protocol stacks in the UMTS base station system and in a GPRS supporting node are different, there is need for an interworking unit. In Figure 2, the interworking unit (IWU) 206 is presented as a separate device, but it may be a part of the RNC or the SGSN as well. Towards the UMTS radio access network, the protocol stack 216 of the interworking unit is similar to that of the UMTS base station system, and towards the GPRS core network it is similar to the protocol stack which in an SGSN faces a radio access network. The protocol stack 216 has only three layers, and the upmost data transmission protocols are BSSGP and GTP. The interworking unit relays the BSSGP data packets further as GTP data packets and *vice versa*.

Signalling related to, for example, radio resource reservation and mobility management, is carried out using a Radio Access Network Application Part (RANAP). In signaling protocol stack, the RANAP replaces the GRPS tunneling protocol in the protocol stack 212 of the UMTS base station system and in the protocol stack 216 of the interworking unit.

Figure 3 presents a schematic drawing of a network, where a GSM radio access network 300 and an UMTS radio access network 310 are connected to a GPRS core network 320. In Figure 3, the GSM radio access network 300 comprises two base stations 102a and 102b, and a base station controller 103. The UMTS radio access network 310 comprises two 3G base stations 202a and 202b, and a radio access network controller 203. The GSM radio access network 300 is connected to the GPRS core network 320 by connecting the BSC 103 to a SGSN 104 of the GPRS core network 320. The UMTS radio access network 310 is connected to the GPRS core network 320 by connecting the RNC 203 to the same SGSN 104. The GPRS core network 320 is connected to a public data network 330 using a GGSN 105.

In the GPRS core network 320 between the SGSN and GGSN a data stream related to a certain connection is identified usually with a certain connection identifier, for example with a flow label. Each GTP packet carrying data related to, for example, a certain IP connection, has the same identifier.

In the GPRS core network, there are subscriber-specific or connection-specific queues for the data packets. For each subscriber there may be many GTP sessions, each of which has a unique identifier, for example the GTP flow label. In the GSM radio access network, the data packet queues are cell-specific, so that the management of the queues is easy in the BSC. Depending on the number of service classes, there may be many packet queues in a specific cell. In a SGSN, the BSSGP

layer is responsible for re-organizing the subscriber-specific data packet queues to cell-specific queues. This re-organizing requires information on the subscriber identifier to which a certain GTP flow label relates and on the cell in which the subscriber is. The correspondence between a GTP flow label or other connection identifier and a subscriber identity may be determined, for example, in the process of radio access network resource reservations when a Packet Data Protocol (PDP) context is being set up.

In UMTS radio access network, the RNC expects the packets arriving from the GPRS core network to be organized in subscriber-specific queues. Therefore between the Gb and Iu interfaces, for example in the IWU, the cell-specific data packet queues have to be re-organized to subscriber-specific queues. An example is presented in Figure 4, which shows the BSSGP layer 400 and GTP layer 410 of an IWU 206. These layers are involved in transmission of user data, signaling data is transmitted using the BSSGP and the RANAP.

The cell-specific data packet queues 411-414 are shown in the BSSGP layer 400. In Figure 4, the BSSGP layer comprises a switching entity 440, which is responsible for organizing the data packets to connection-specific queues 421-422. As an example, data packets 401-403 are shown to be heading to a certain cell in the UMTS radio access network 310. The data packets belong to different packet data connections, and therefore they are placed to separate transmission queues 421, 423 and 424. In Figure 4, the switch management entity 441 comprises information about connections A, B, C and D. For these connections a PDP context has been established between a mobile station within the UMTS radio access network 310 and a GGSN. The information may be received, for example, from a subscriber database in a SGSN. In Figure 4, a subscriber database 450 is presented and arrow 431 shows how the necessary information in the database is signaled to the switch management entity.

The problem is that in certain situations a SGSN may transmit packets towards a UMTS radio access network without checking if the receiver mobile station has successfully carried out resource reservation in the UMTS radio access network and has established a PDP context. In a handover from a GSM radio access network to an UMTS radio access network it may happen that the SGSN receives information from the GSM radio access network that a handover has been completed, but the UMTS radio access network has not yet reserved resources for the GPRS data related to this mobile station. The SGSN may direct downlink data at once to the UMTS radio access network, but in the IWU, or corresponding functionality

incorporated to the RNC or SGSN, for example, there is no information about the PDP context. The IWU, for example, does not have a proper transmission queue where to place the data packets with a certain GTP flow label. It has to discard the data packets. Other packets heading to other mobile stations within the UMTS radio access network may suffer from additional delays due to the time consumed by the processing of the data packet without a proper PDP context. Further, if some data packets are deleted without informing the SGSN, it may send the packets again without realizing that the problem is actually the lack of reservations or an unestablished PDP context in the UMTS radio access network.

10 The object of the invention is to present a method for transmitting data packets reliably. A further object is to present a method for transmitting data packets when proper transmission resources have not been reserved for the data packets beforehand.

15 The object of the invention is achieved by triggering resource reservation on the arrival of unswitchable packets that comprise a proper identifier for carrying out the resource reservation.

A method according to the invention is a method for transmitting data packets, where

- a packet data connection is indicated with a connection identifier and the destination of the packet data connection is indicated with a destination identifier,
- data packets are sorted into initialized transmission queues before transmission,
- a destination identifier is involved in the initialization of a transmission queue,
- at least one connection identifier is related to each transmission queue,
- a set of proper connection identifiers is the union of the connection identifiers related to the initialized transmission queues and
- a data packet having a proper connection identifier is placed to the transmission queue determined by the connection identifier, and it is characterized in that the initialization of a new transmission queue is triggered by a data packet not having a proper connection identifier and having a destination identifier and
- after a successful initialization of a new transmission queue the data packet that triggered the initialization is placed to the new transmission queue.

A network element according to the invention comprises

- means for storing data packet to transmission queues,
- means for indicating the connections related to each transmission queue with connection identifiers,

- means for detecting a connection identifier in a data packet, and
 - means for placing a data packet to an initialized transmission queue whose connection identifier is equal to the connection identifier in the data packet, and it is characterized in that it further comprises means for triggering the
- 5 initialization of a new transmission queue on the arrival of a data packet not having a connection identifier equal to any of the connection identifiers of the transmission queues and having a destination identifier.

The appended dependent claims describe some preferred embodiments of the invention.

- 10 In a method according to the invention data packets, which are being transmitted from one place to another, are sorted to transmission queues at some point of the connection. To each transmission queue packets related to a certain connection or to certain connections are placed. From the queues the packets may be transmitted further according to some specified priority rules, for example.
- 15 A transmission queue is initialized before packets are placed to the queue. This initialization typically involves some transmission resource reservations. Information about the destination of a connection is therefore needed, when a transmission queue is initialized. The destination identifier may be, for example, a network address of the destination or a name of the destination. A connection
- 20 identifier can be associated to a certain transmission queue in the initialization or at a later stage. The invention does not specify, for example, a protocol using which the connection identifier is related to a transmission queue. The connection identifier may be, for example, a flow label of a certain packet data protocol. In a method according to the invention, transmission queues may be initialized
- 25 dynamically. The establishment of a packet data connection involves the initialization of a transmission queue related to the connection.

- Data packets having a connection identifier, which is equal to one of the queue identifiers of the initialized transmission queues, are placed to the queue having the same identifier. If a data packet comprises no connection identifier or if the
- 30 connection identifier it comprises is not equal to any of the connection identifiers of the transmission queues, then there is no transmission queue where to place the data packet. In this case, it is checked if the data packet comprises a destination identifier, using which a new transmission queue can be initialized. If it comprises a destination identifier, the initialization of a new queue is triggered, i.e. resource

reservations may be carried out. If there is not a destination identifier in the data packet, then the packet may be discarded.

The advantage of a method according to the invention is that if there is a situation where a connection has not been properly set up and there is no transmission queue
5 related to a certain connection identifier, data packets having that connection identifier can be transmitted further without an extensive delay or without the sender re-sending it. If, for example, a mobile station has performed a handover and data packets related to a certain packet data connection are sent to the new location before information about the packet data connection is signaled to the radio access
10 network, the arrival of a data packet heading to the mobile station triggers the signaling necessary for establishing the packet data connection.

Future, if the initialization of the transmission queue is not successful, then the sender of the data packet may be informed not to send data packets related to this certain connection.

15 The incoming data packets may be, for example, sorted to queues based on a different label or they may be unsorted. The invention does not specify in which order the incoming data packets are processed.

The invention will now be described more in detail with reference to the preferred embodiments by the way of example and to the accompanying drawings where

20 Figure 1 shows a schematic drawing of a second generation radio access network and core packet network,

Figure 2 shows a schematic drawing of a third generation radio access network and core packet network,

25 Figure 3 shows a schematic drawing of a second generation and a third generation radio access network connected to a core packet network,

Figure 4 shows a schematic drawing of transmission of data packets on the edge of a GPRS core network and a UMTS radio access network,

Figure 5 shows a flowchart of a method for transmitting data packets according to a first preferred embodiment of the invention,

30 Figure 6 shows a flowchart of a method for transmitting data packets according to a second preferred embodiment of the invention,

Figure 7 shows a schematic drawing of transmission of data packets according to the invention on the edge or a GPRS core network and a UMTS radio access network, and

5 Figure 8 shows a schematic drawing of a network element and an arrangement, where methods according to any preferred embodiment of the invention have been implemented.

Figure 5 presents a schematic drawing of a method 500 according to a first preferred embodiment of the invention. In this method, data packets are sorted to transmission queues. The sorting is done based on a connection identifier. Each data packet
10 related to a certain connection, for example, carries a same queue identifier.

In step 501 a data packet is taken under inspection. The data packet may be, for example, an incoming data packet. In step 502 it is checked if the data packet comprises a connection identifier. If it does, then in step 503 the connection identifiers related to the transmission queues currently in use are checked. In step
15 504 the connection identifier in the data packet is compared to the connection identifiers related to the transmission queues. If there is a transmission queue to which the connection identifier is related, then in step 505 the data packet is placed to that transmission queue. This is the case when a certain packet data connection has been successfully established to the destination before the arrival of a data
20 packet belonging to the packet data connection.

If the data packet comprises no connection identifier or the connection identifier is not a proper connection identifier (i.e. none of the connection identifier related to the transmission queues is equal to the connection identifier in the data packet), the data packet cannot be placed to any of the existing transmission queues. In step 506
25 it is checked, if the data packet comprises a destination identifier. If there is no destination identifier, it is not possible to find out where the data packet is heading, and therefore it is discarded in step 507.

If the data packet comprises a destination identifier, for example a network address or a name of the destination, then it is possible to establish a packet data connection
30 towards the destination. In step 508 the initialization of a new transmission queue is triggered, and the initialization of the transmission queue may involve, for example, reservation of transmission resources and setting up a packet data connection. In step 509, the data packet is placed to the new transmission queue.

If the data packet that triggers the initialization of a new transmission queue does not comprise a connection identifier, the initialization process has to establish one.

After one data packet is processed, either placed to an existing or to a new transmission queue or discarded, in the method according to the first preferred embodiment of the invention the next data packet is processed similarly.

It is possible that the initialization of a transmission queue is not successful. The initialization may also take some time and during this time it is advisable to process other data packets. Figure 6 present a flowchart of a method 600 according to a second preferred embodiment of the invention where these issues are taken into account.

The method according to the second preferred embodiment of the invention comprises two simultaneous loops. The upper part of Figure 6 presents the loop where it is checked, if a data packet can be placed to an existing transmission queue. It comprises of steps 501-505 which are similar to the steps of the method 500 according to the first preferred embodiment of the invention. If the processed data packet comprises no connection identifier or the connection identifier is not equal to any of the connection identifiers related to the existing transmission queues, then the data packet is placed to a buffer in step 601.

The lower part of Figure 6 presents the second loop of the method according to the second preferred embodiment of the invention. In step 602, a data packet placed to the buffer is taken under inspection. In step 506 it is checked, if there is a destination identifier in the data packet. If there is none, then the data packet is discarded in step 507 and the next data packet in the buffer is processed in step 602. If the data packet in the buffer comprises a destination identifier, in step 508 the initialization of a transmission queue is triggered. This initialization may involve, for example, reservation of transmission resources using a specific signaling protocol. After a response is attained, it is checked in step 604 if the transmission queue initialization was successful. If it was not possible to carry out the initialization procedure, then a data packet is discarded in step 604. In step 604 the sender of the data packet (or the nearest network node from where the data packet came) is informed that packets to this connection or to this destination should not be sent here. If the initialization of the new transmission queue was successful, in step 505 the data packet is placed to the new transmission queue.

Data packets related to a packet data connection between a public packet data network and a mobile station reachable through a third generation cellular system can be processed using the method according to the second preferred embodiment of the invention. This method may be implemented in the interworking unit between
5 the GPRS core network and an UMTS radio access network.

Figure 7 shows how a BSSGP protocol layer 400 in an interworking unit may be modified to support a method according to the invention. The modifications may be done to the switch management entity 700, for example by adding a triggering entity 710 that performs the steps of the second loop of a method according to the second
10 preferred embodiment of the invention. The triggering entity 710 comprises a buffer 711, where those GTP data packets that do not comprise a connection identifier, for example a GTP flow label, for which there is a transmission queue. To trigger resource reservation requires signaling, this is presented in Figure 7 with arrow 720. The signaling may be done, for example using RANAP signaling.

15 A data packet 701 that does not have a GTP flow label corresponding to a connection for which resources have been reserved is placed to buffer 711 (step 601 in Figure 6). If the data packet comprises a destination identifier, for example an International Mobile Subscriber Identifier (IMSI), a Temporary Mobile Subscriber Identifier (TMSI) or a Temporary Logical Link Identifier (TLLI), this destination
20 identifier may be signaled to the radio access network. The triggering entity 710 in the BSSGP switch management entity may, for example, send a triggering message to the RANAP layer. The triggering message indicates the destination identifier, which is necessary in the resource reservation.

After receiving the triggering message, the RANAP layer of the interworking unit
25 starts to reserve resources in the radio access network. For example, a BEARER_REQUEST message of the RANAP protocol may be sent to the Radio Network Controller. The RNC may answer using either a BEARER_REQUEST_COMPLETE message (resources for the packet data connection have been reserved) or a BEARER_REQUEST_FAILURE message
30 (resource reservation was unsuccessful). After receiving the response, the RANAP layer of the interworking unit may notify the BSSGP layer of the interworking unit that resources have been reserved (step 604 in Figure 6). Because the resources have been reserved, a transmission queue (queue 725 in Figure 7) has been initialized in the BSSGP layer 400 and the data packet can be placed to the queue. From the
35 transmission queue the packet is further transmitted to the radio access network and to the right mobile station.

After reserving resources for a packet data connection, the RANAP may automatically update the subscriber database in, for example, SGSN by adding information related to the packet data connection there. It is also possible that the BSSGP layer sends information about the packet data connection to the subscriber database. The management of packet data connections in radio access network usually requires that information about the packet data connections is available in a subscriber database.

It is possible that transmission resources cannot be reserved, for example because the mobile station the destination identifier indicates is not in the cell the subscriber database indicates or because all the radio resources are already in use. In this case the triggering entity 710 may inform the SGSN that sent the data packet that the mobile station, to which the packet data connection is related, is not reachable through the RNC the SGSN expected (step 605 in figure 6). It may signal the information directly to the subscriber database using, for example, proprietary signaling or RANAP signaling. Thereafter the SGSN can, for example, start paging the mobile station to update the information in the subscriber database.

Certain data packets, such as GTP-U packets which carry user data, do not carry any information about the mobile station. On the other hand, GTP-C packets, which carry signaling data related to the management of the actual GTP connections, carry information about the destination mobile station, too. Therefore it is possible to place only GTP-C packets or other signaling packets to the buffer 711. Other packets, for example GTP-U packets with a flow label not corresponding to any of the transmission queues, may be discarded directly.

The re-organization of cell-specific queues to connection-specific queues as presented in Figure 7 may be performed, for example, in the SGSN before sending the data packets to the UMTS radio access network, in an interworking unit, or in the RNC in the UMTS radio access network.

Figure 8 presents a network element 800 where a method according to the invention is implemented. The incoming data packets are received in the block 801. The connection identifier detection block 802 performs the tasks related to step 501 of the methods according to the invention. It may, for example, check if the data packet comprises a certain data field of a protocol header. The queue selection block 803 is responsible for choosing the right transmission queue for the data packet. The transmission queues block 804 comprises information about the connection identifiers for which proper resource reservations have been carried out. The adding

to queue block 805 adds the data packet to the correct queue, and the queue initialization triggering block 806 is responsible, for example, for signaling related to resource reservations. From the transmission queue the data packets are transmitted further in the packet transmission block 807. The blocks may be
5 implemented using, for example, microprocessors and suitable software.

The network element according to the invention may be, for example, a SGSN in a GPRS core network, a IWU between a GPRS core network and an UMTS radio access network, or a RNC an UMTS radio access network.

The methods according to the invention are not restricted to those used only in
10 cellular networks. It is possible to use methods according to the invention, for example, in packet data networks where transmission resources have to be reserved before transmitting data packets.

The network elements according to the invention are not restricted to network elements of cellular networks.

Claims

1. A method for transmitting data packets, where
 - a packet data connection is indicated with a connection identifier and the destination of the packet data connection is indicated with a destination identifier,
 - 5 - data packets are sorted (504, 505) into initialized transmission queues before transmission,
 - a destination identifier is involved in the initialization of a transmission queue,
 - at least one connection identifier is related to each transmission queue,
 - a set of proper connection identifiers is the union of the connection identifiers
 - 10 related to the initialized transmission queues and
 - a data packet having a proper connection identifier is placed (505) to the transmission queue determined by the connection identifier, characterized in that
 - the initialization of a new transmission queue is triggered (506, 508) by a data packet not having a proper connection identifier and having a destination identifier
 - 15 and
 - after a successful initialization of a new transmission queue the data packet that triggered the initialization is placed (509) to the new transmission queue.
2. A method according to claim 1, characterized in that the activation of a new queue is triggered by a data packet not having a queue identifier.
- 20 3. A method according to the claim 1, characterized in that the activation of a new queue is triggered by a data packet having a queue identifier that is not a proper queue identifier.
4. A method according to claim 1, characterized in that the sender of a data packet is notified (605) if the initialization of a new transmission queue is not
- 25 successful.
5. A method according to claim 1, characterized in that a certain data field in a protocol packet header is used as the connection identifier.
6. A method according to claim 5, characterized in that a flow label of General Packet Radio Service Tunneling Protocol header is used as the connection identifier
- 30 and a certain cellular network subscriber identifier is used as the destination identifier.

7. A method according to claim 1, characterized in that transmission resources in a radio access network are reserved, when the initialization of a new queue is triggered.
- 5 8. A method according to claim 7, characterized in that transmission resources are reserved using Radio Access Network Application Part in Universal Mobile Communication System.
9. A network element, which comprises
- means for storing data packet to transmission queues,
 - means for indicating (804) the connections related to each transmission queue with

10 connection identifiers,

 - means for detecting (802) a connection identifier in a data packet, and
 - means for placing (805) a data packet to an initialized transmission queue whose connection identifier is equal to the connection identifier in the data packet,

15 characterized in that it further comprises means for triggering (806) the initialization of a new transmission queue on the arrival of a data packet not having a connection identifier equal to any of the connection identifiers of the transmission queues and having a destination identifier.

10. A network element according to claim 9, characterized in that it is a network element of a cellular network.

20 11. A network element according to claim 10, characterized in that it is a network element of a Universal Mobile Telecommunication System.

12. A network element according to claim 11, characterized in that it is a radio network controller.

13. A network element according to claim 10, characterized in that it is a network

25 element of a General Packet Radio Service core network.

14. A network element according to claim 13, characterized in that it is a Serving GPRS Supporting Node.

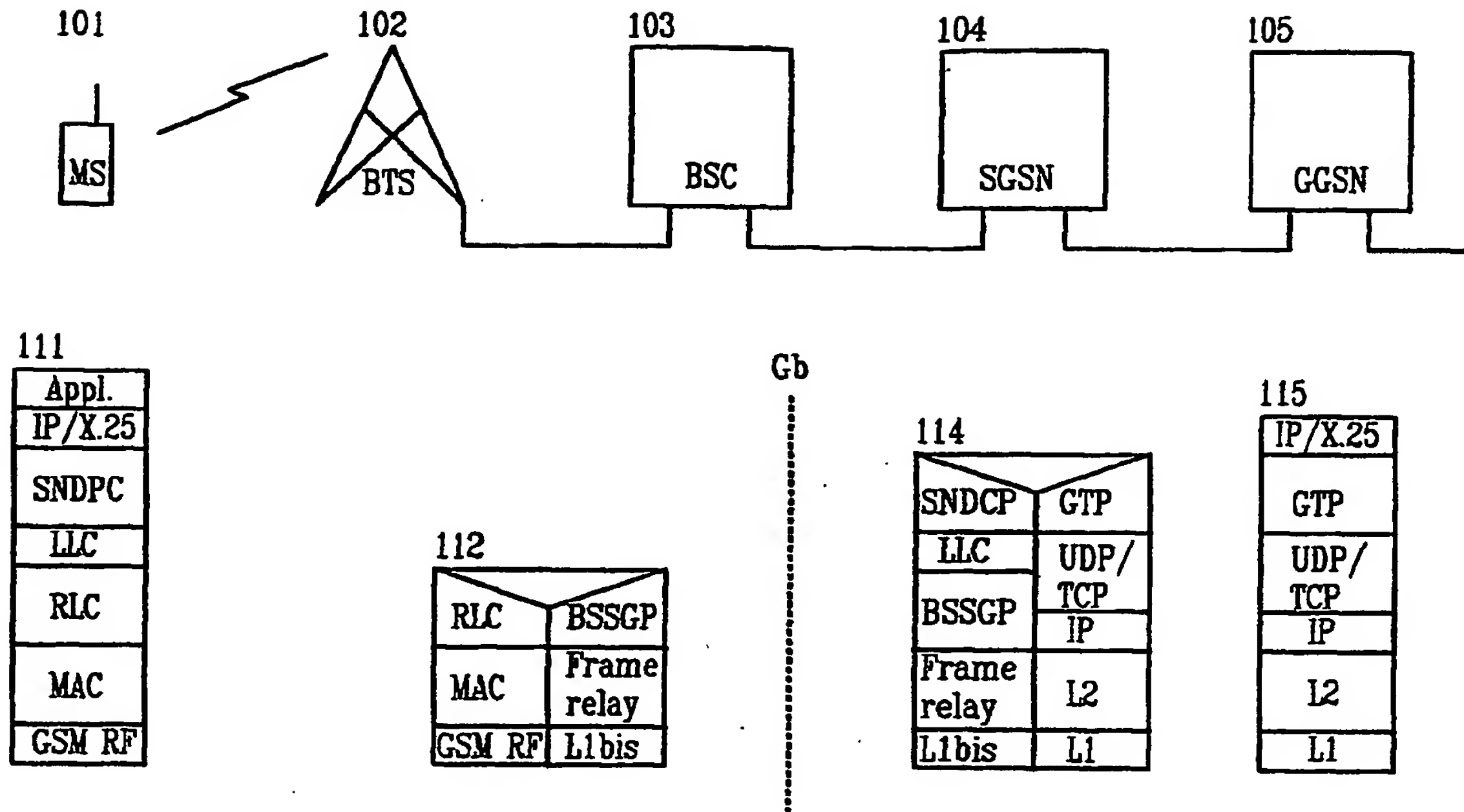


FIG. 1 PRIOR ART

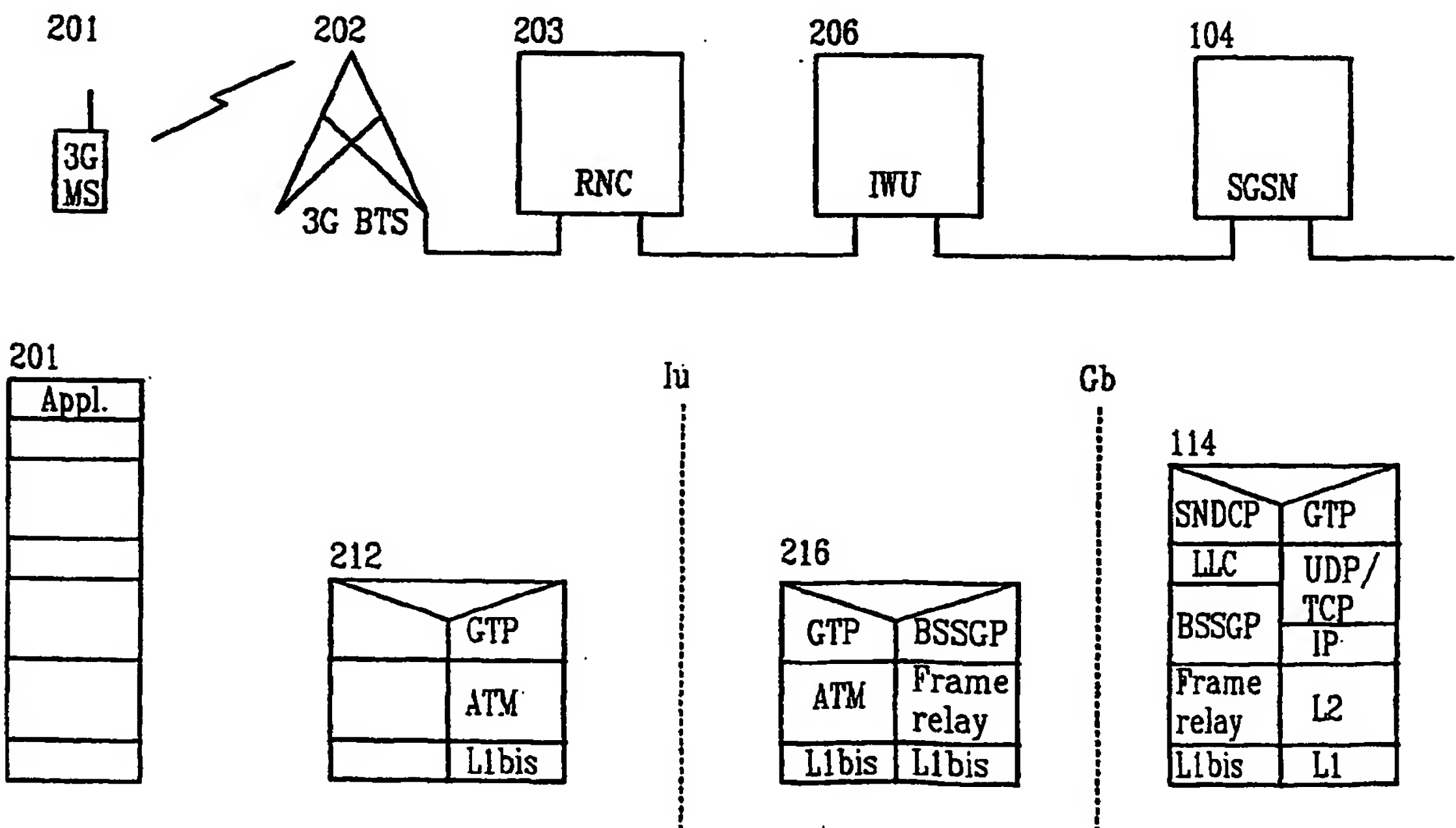


FIG. 2 PRIOR ART

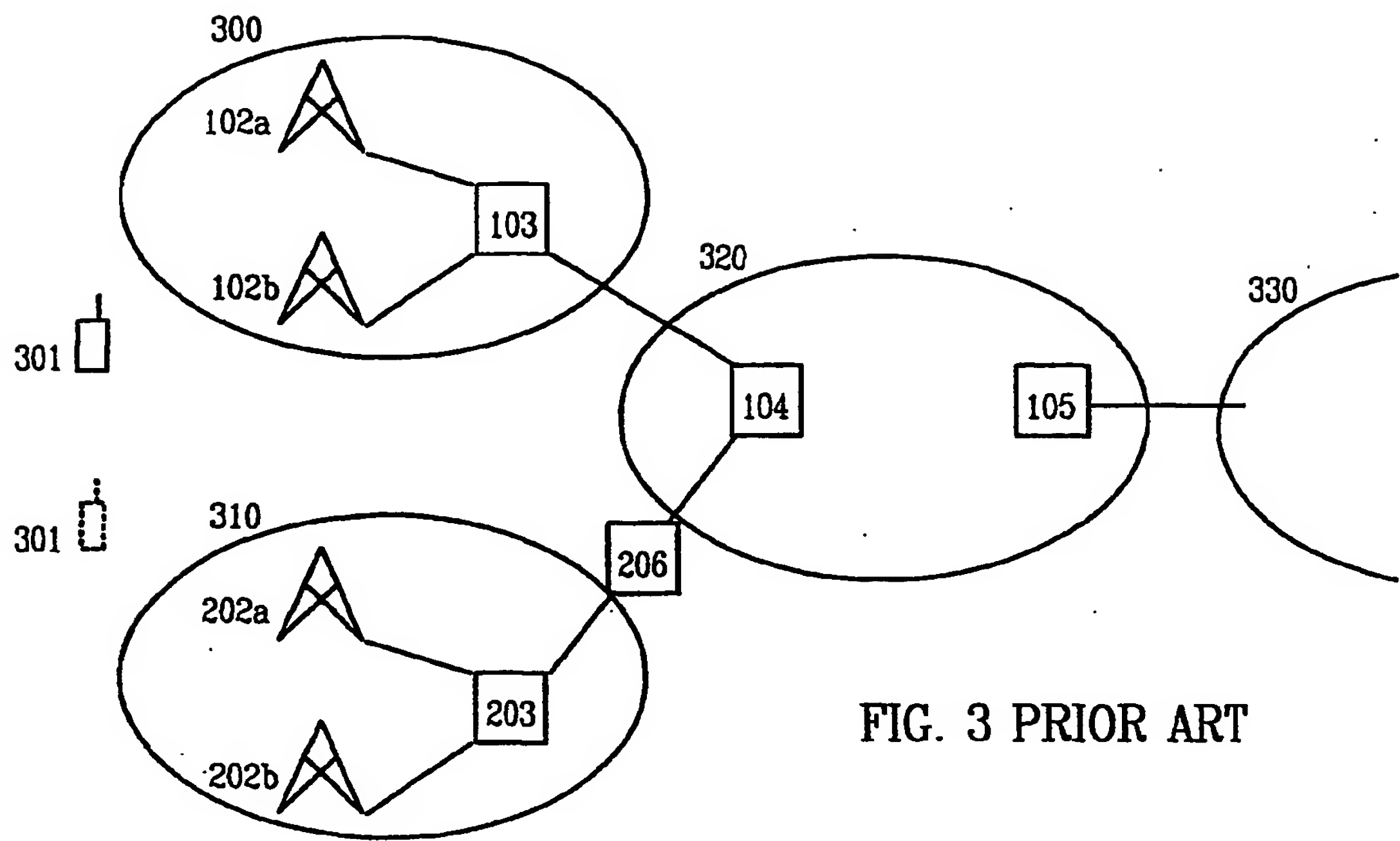


FIG. 3 PRIOR ART

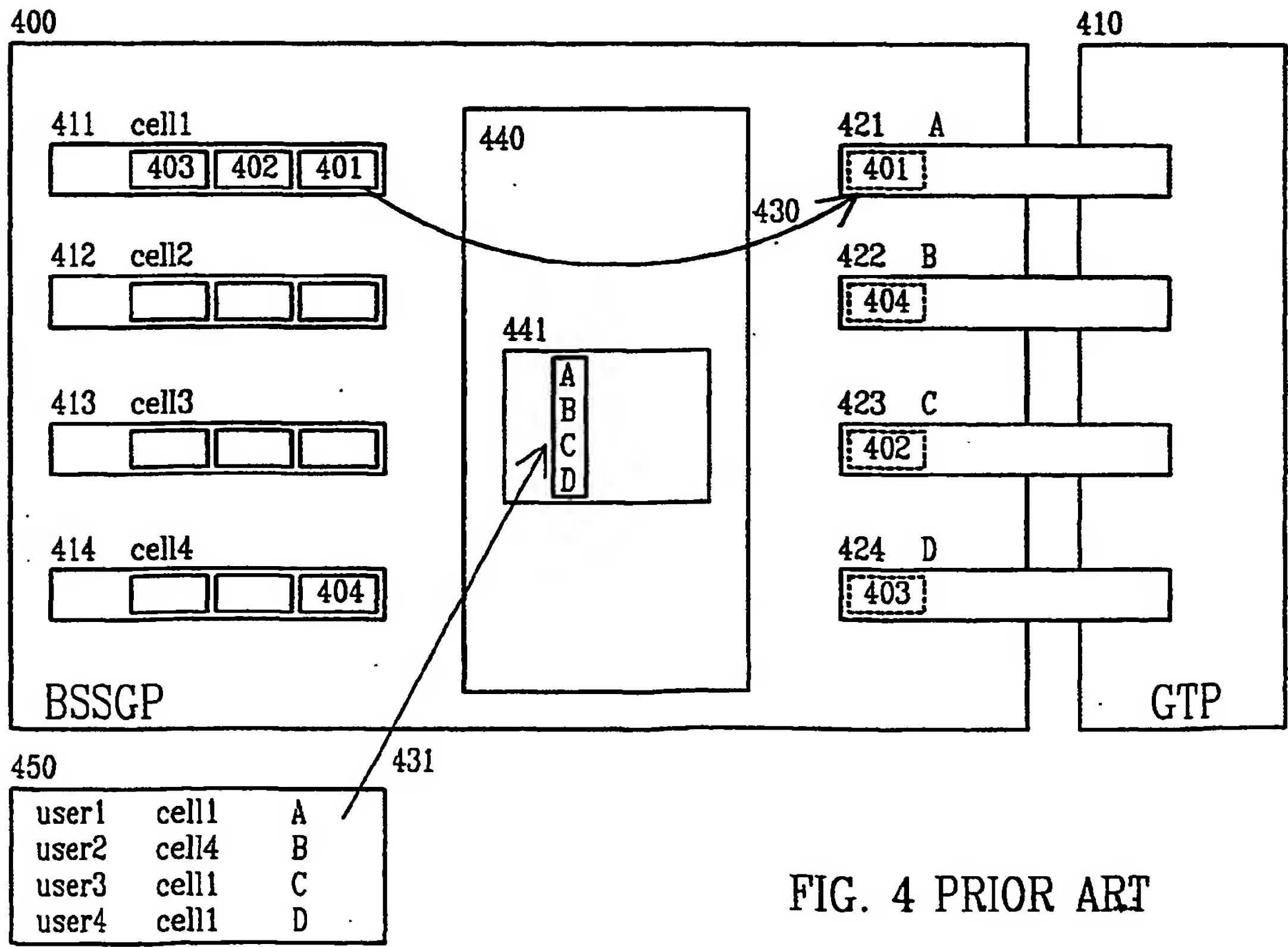


FIG. 4 PRIOR ART

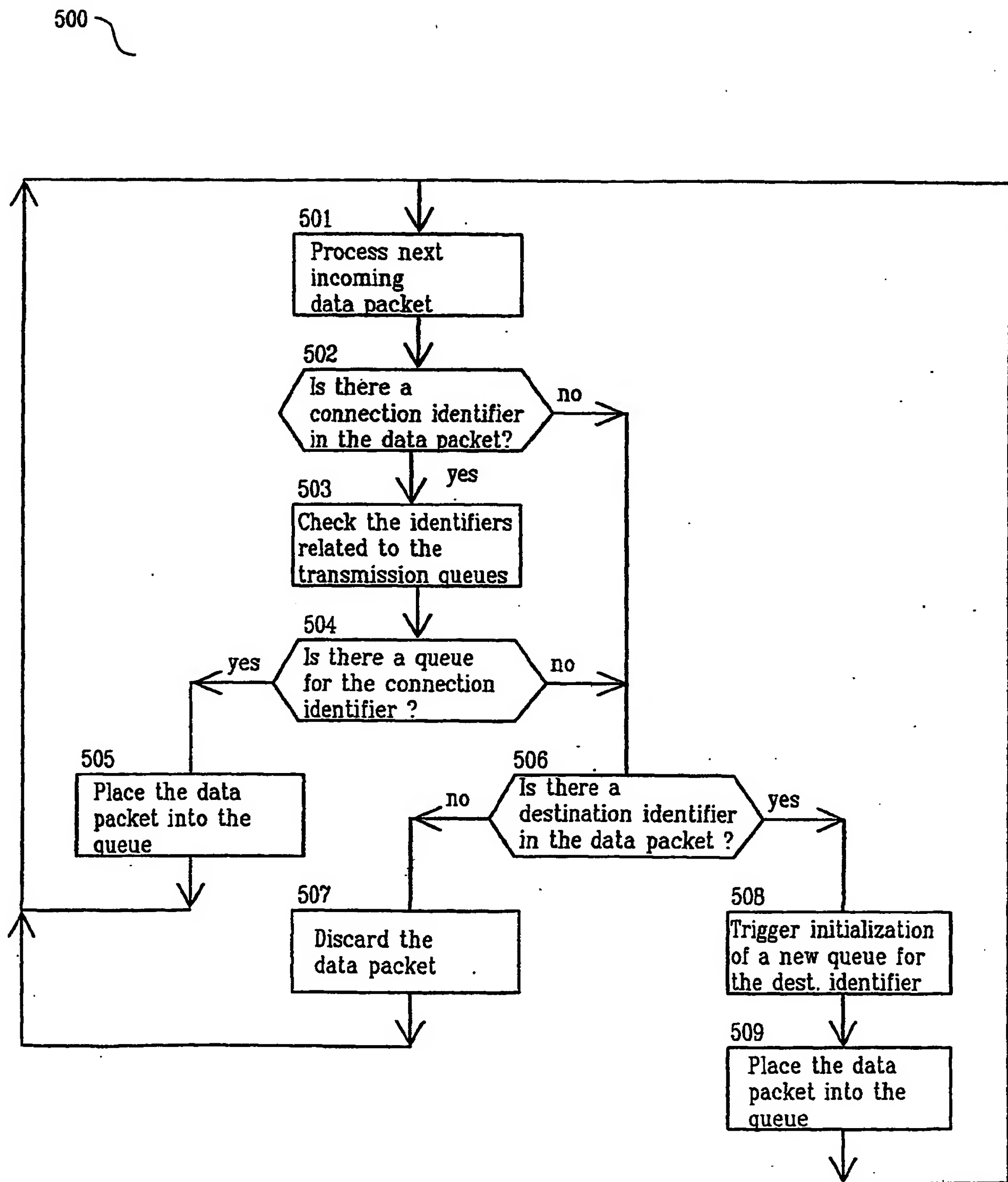
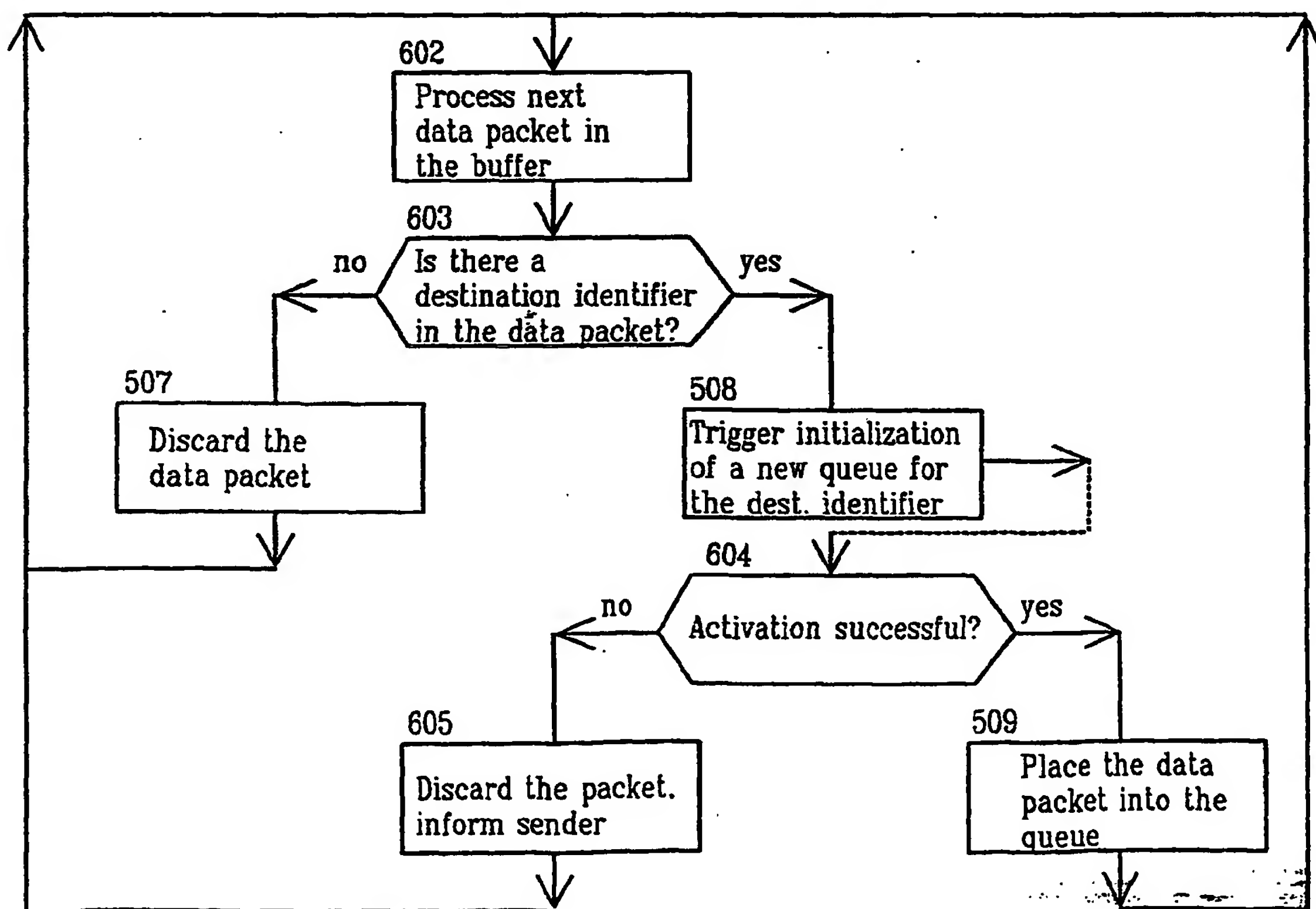
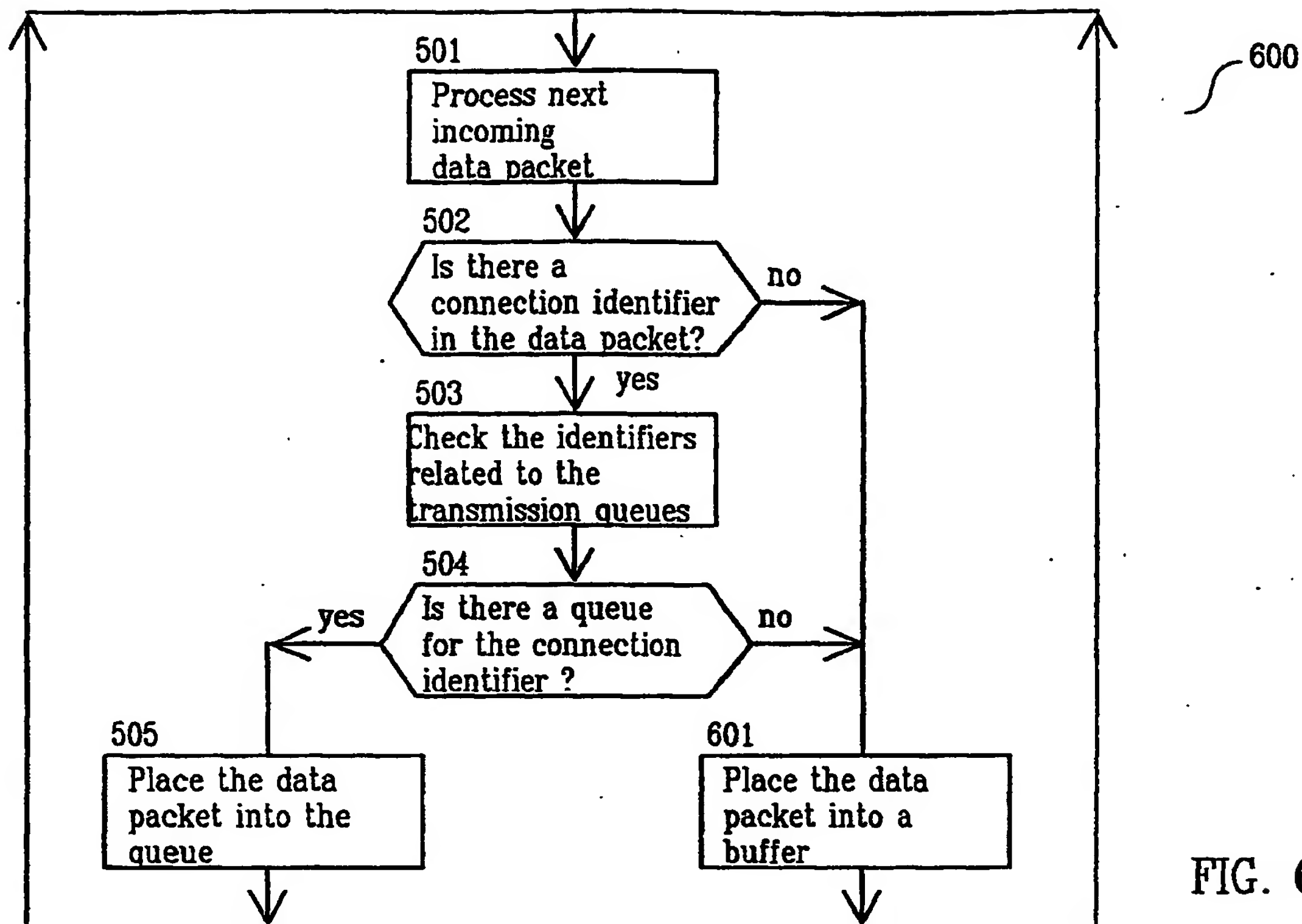


FIG. 5

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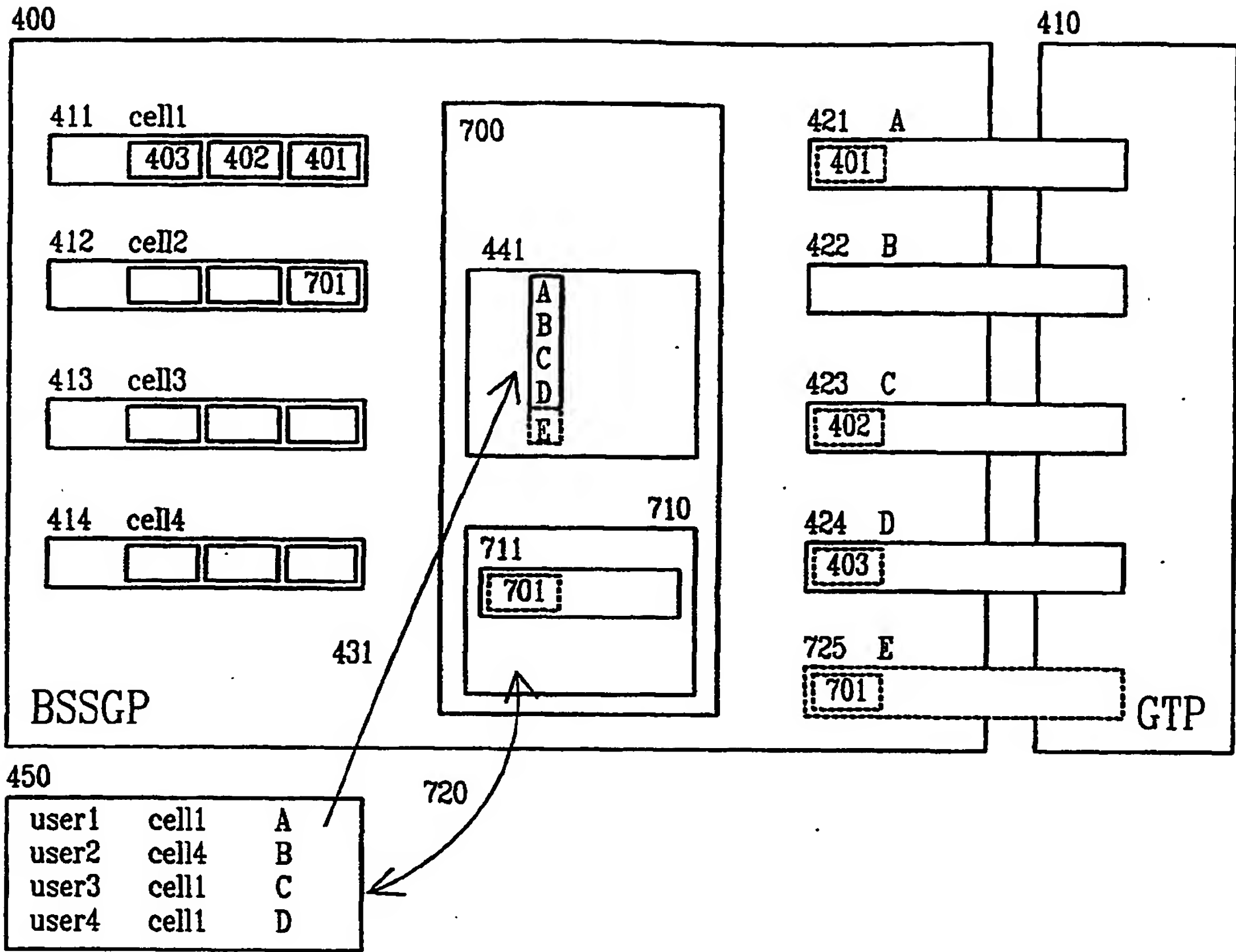


FIG. 7

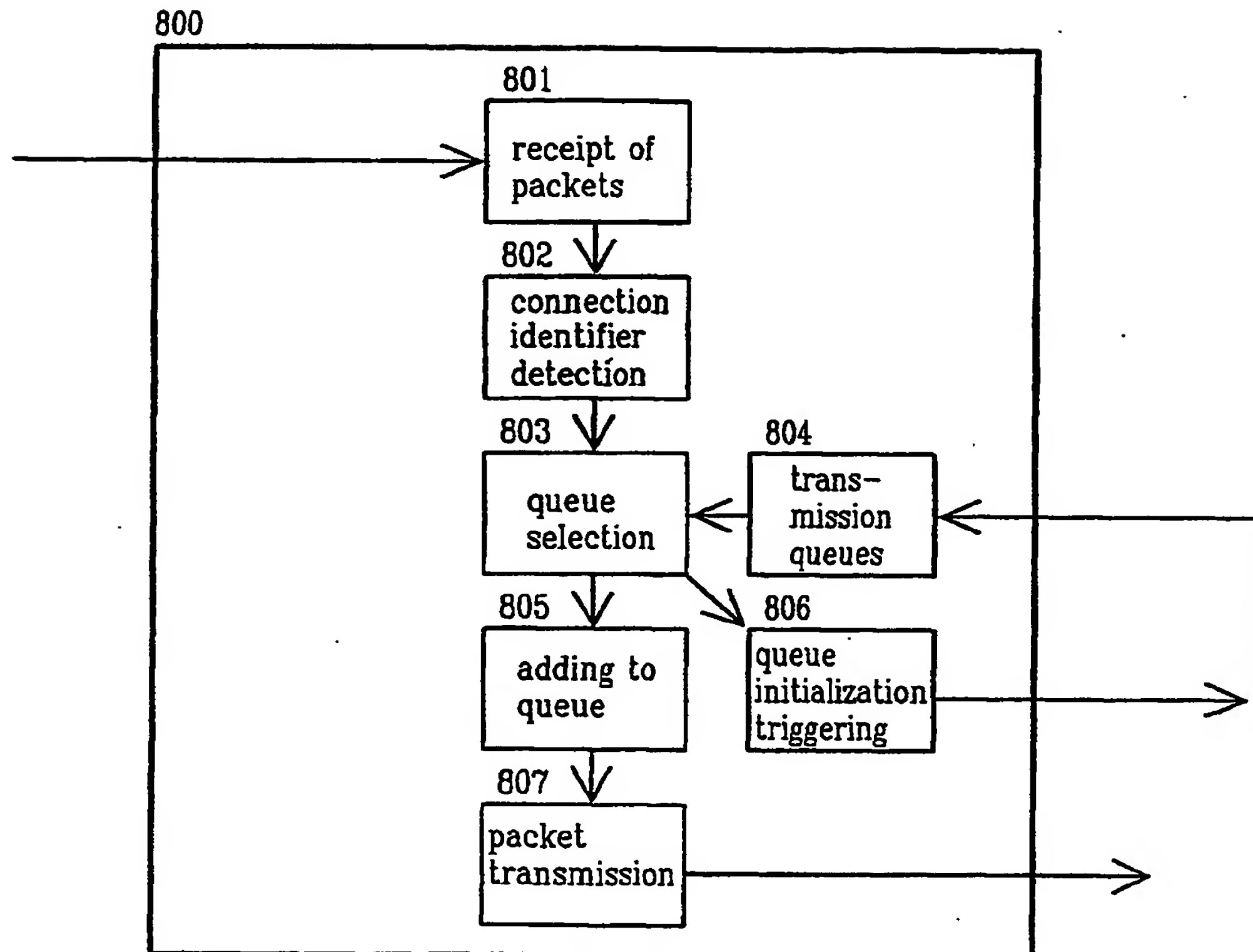


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 01/00599

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 12/56, H04Q 7/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPO INTERNAL, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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| A | WO 9407316 A1 (NETWORK EQUIPMENT TECHNOLOGIES, INC.), 31 March 1994 (31.03.94), page 32, line 36 - page 33, line 7; page 27, line 23 - line 29 -- | 1-14 |
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents

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Date of the actual completion of the international search

Date of mailing of the international search report

7 November 2001

30. 11. 2001

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/00599

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Information on patent family members

International application No.

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